FAIRCHILD SEMICONDUCTOR®

February 2012

# FDP047N10
## N-Channel PowerTrench® MOSFET
### 100V, 164A, 4.7mΩ

## Description

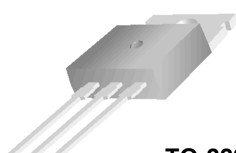
- $R_{DS(on)}$ = 3.9mΩ ( Typ.) @ $V_{GS}$ = 10V, $I_D$ = 75A
- Fast switching speed
- Low gate charge
- High performance trench technology for extremely low $R_{DS(on)}$
- High power and current handing capability
- RoHS compliant

## General Description

This N-Channel MOSFET is producedusing Fairchild Semiconductor's advance PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

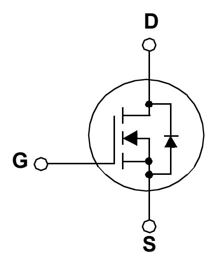
## Application

- DC to DC converters / Synchronous Rectification



G D S

TO-220




## MOSFET Maximum Ratings $T_C$ = 25°C unless otherwise noted*

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | 100 | V |
| $V_{GSS}$ | Gate to Source Voltage | | ±20 | V |
| $I_D$ | Drain Current | - Continuous ($T_C$ = 25°C, Silicon Limited) | 164* | A |
| | | - Continuous ($T_C$ = 100°C, Silicon Limited) | 116* | A |
| | | - Continuous ($T_C$ = 25°C, Package Limited) | 120 | A |
| $I_{DM}$ | Drain Current | - Pulsed (Note 1) | 656* | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy | (Note 2) | 1153 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 6.0 | V/ns |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | 375 | W |
| | | - Derate above 25°C | 2.5 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | -55 to +175 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | | 300 | °C |

*Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 120A.

## Thermal Characteristics

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 0.4 | °C/W |
| $R_{\theta CS}$ | Thermal Resistance, Case to Sink Typ. | 0.5 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 62.5 | |

## Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDP047N10 | FDP047N10 | TO-220 | - | - | 50 |

## Electrical Characteristics $T_C = 25^oC$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|

### Off Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D = 250\mu A$, $V_{GS} = 0V$, $T_J = 25^oC$ | 100 | - | - | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\mu A$, Referenced to $25^oC$ | - | 0.1 | - | $V/^oC$ |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS} = 100V$, $V_{GS} = 0V$ | - | - | 1 | $\mu A$ |
| | | $V_{DS} = 100V$, $V_{GS} = 0V$, $T_C = 150^oC$ | - | - | 500 | |
| $I_{GSS}$ | Gate to Body Leakage Current | $V_{GS} = \pm 20V$, $V_{DS} = 0V$ | - | - | ±100 | nA |

### On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}$, $I_D = 250\mu A$ | 2.5 | 3.5 | 4.5 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10V$, $I_D = 75A$ | - | 3.9 | 4.7 | $m\Omega$ |
| $g_{FS}$ | Forward Transconductance | $V_{DS} = 10V$, $I_D = 75A$ (Note 4) | - | 170 | - | S |

### Dynamic Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{DS} = 25V$, $V_{GS} = 0V$<br>f = 1MHz | - | 11500 | 15265 | pF |
| $C_{oss}$ | Output Capacitance | | - | 1120 | 1500 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 455 | 680 | pF |

### Switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 50V$, $I_D = 75A$<br>$V_{GS} = 10V$, $R_{GEN} = 25\Omega$<br>(Note 4, 5) | - | 174 | 358 | ns |
| $t_r$ | Turn-On Rise Time | | - | 386 | 782 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 344 | 698 | ns |
| $t_f$ | Turn-Off Fall Time | | - | 244 | 499 | ns |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{DS} = 80V$, $I_D = 75A$<br>$V_{GS} = 10V$<br>(Note 4, 5) | - | 160 | 210 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | - | 56 | - | nC |
| $Q_{gd}$ | Gate to Drain "Miller" Charge | | - | 36 | - | nC |

### Drain-Source Diode Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $I_S$ | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 164* | A |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 656 | A |
| $V_{SD}$ | Drain to Source Diode Forward Voltage | $V_{GS} = 0V$, $I_{SD} = 75A$ | - | - | 1.25 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS} = 0V$, $I_{SD} = 75A$<br>$dI_F/dt = 100A/\mu s$ (Note 4) | - | 88 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 245 | - | nC |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 0.41mH, $I_{AS} = 75A$, $V_{DD} = 50V$, $R_G = 25\Omega$, Starting $T_J = 25°C$
3. $I_{SD} \le 75A$, $di/dt \le 200A/\mu s$, $V_{DD} \le BV_{DSS}$, Starting $T_J = 25°C$
4. Pulse Test: Pulse width $\le 300\mu s$, Duty Cycle $\le 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

**Figure 1. On-Region Characteristics**

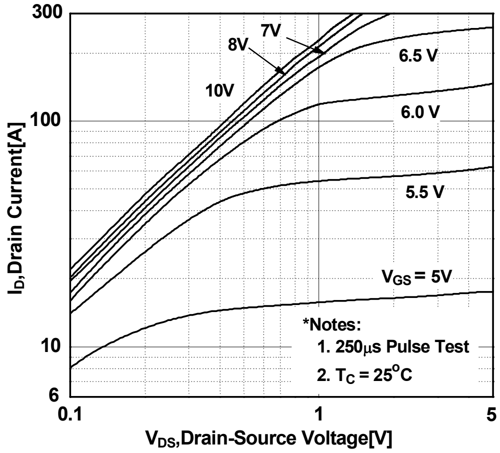



**Figure 2. Transfer Characteristics**

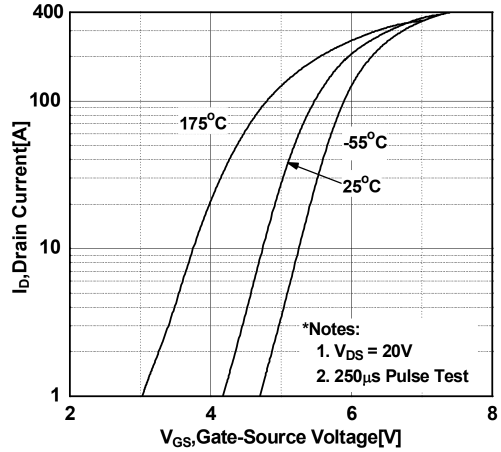



**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

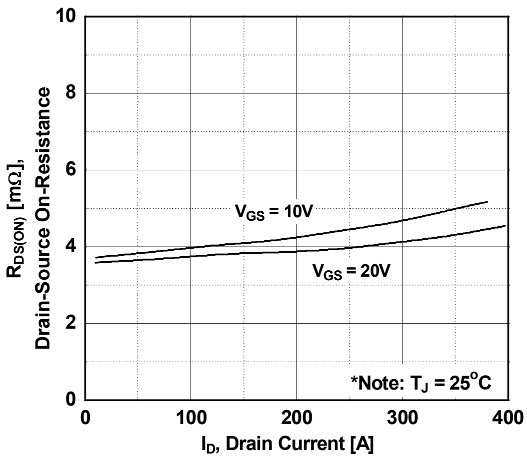



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

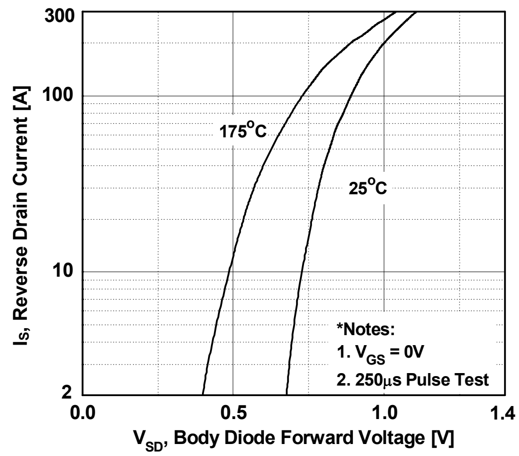



**Figure 5. Capacitance Characteristics**

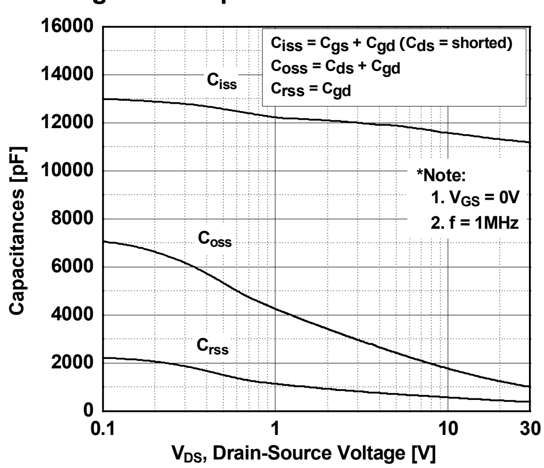
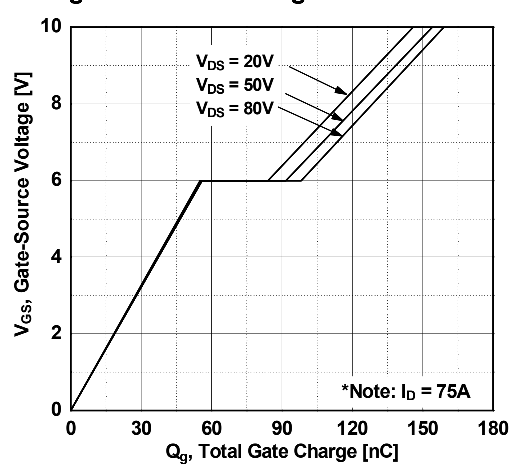



**Figure 6. Gate Charge Characteristics**



## Typical Performance Characteristics (Continued)

**Figure 7. Breakdown Voltage Variation vs. Temperature**

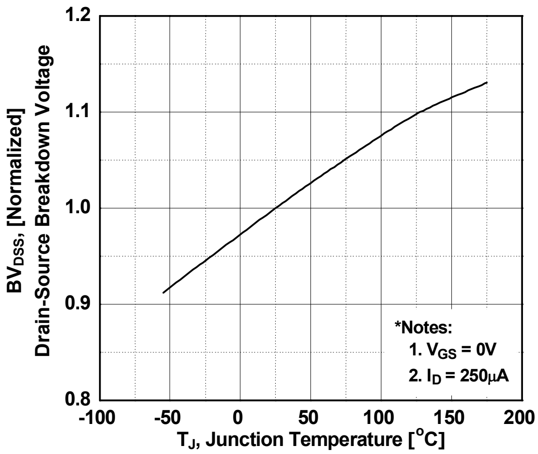



**Figure 8. On-Resistance Variation vs. Temperature**

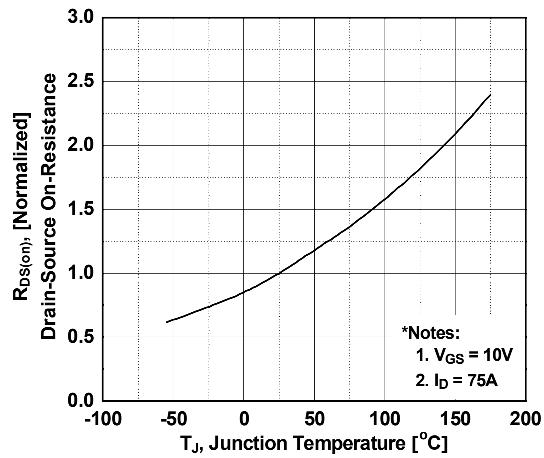



**Figure 9. Maximum Safe Operating Area**

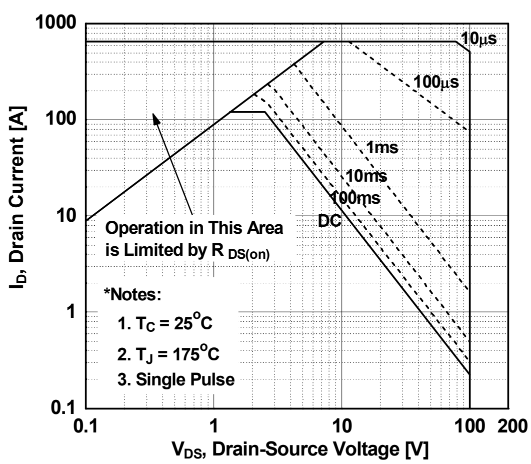



**Figure 10. Maximum Drain Current vs. Case Temperature**

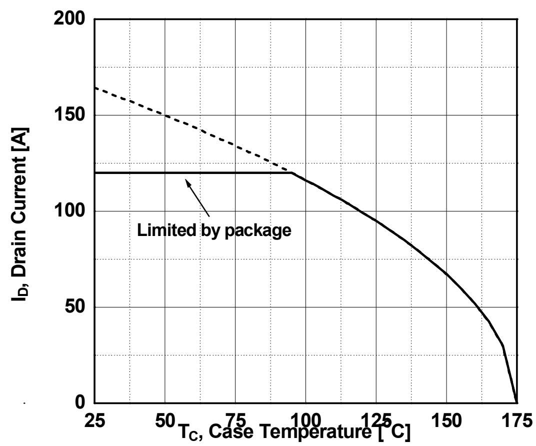
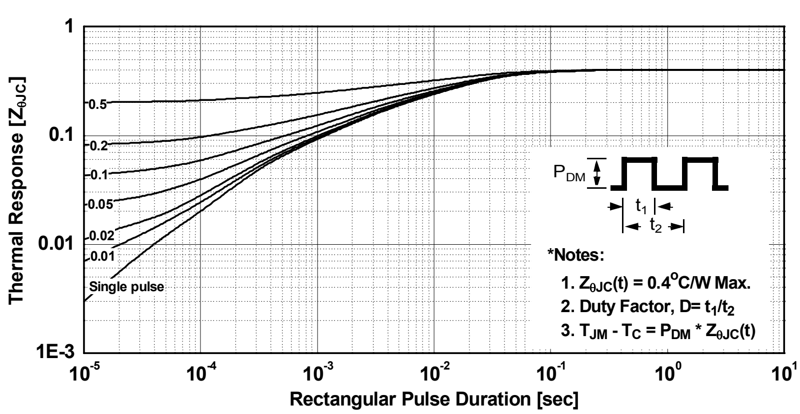
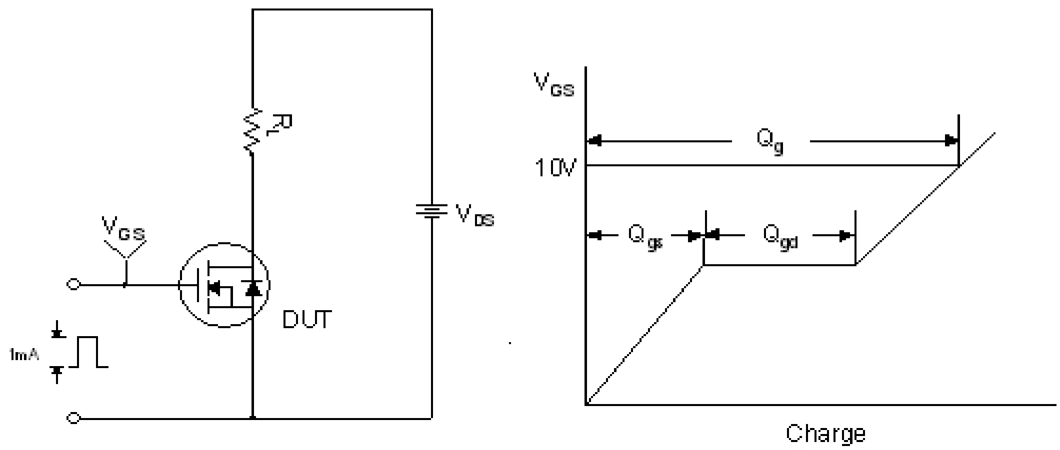


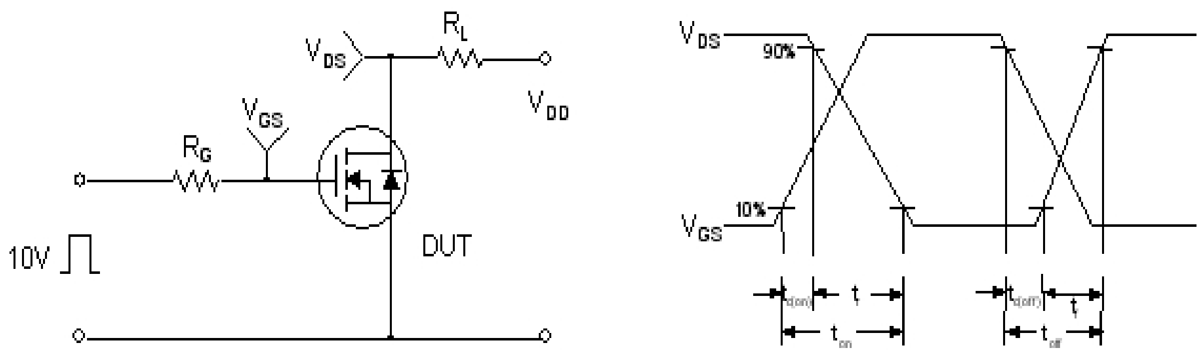

**Figure 11. Transient Thermal Response Curve**



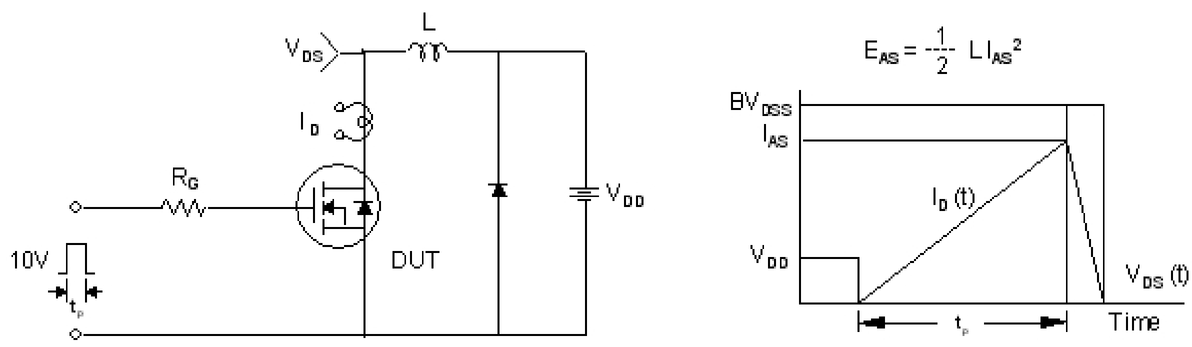
**Gate Charge Test Circuit & Waveform**



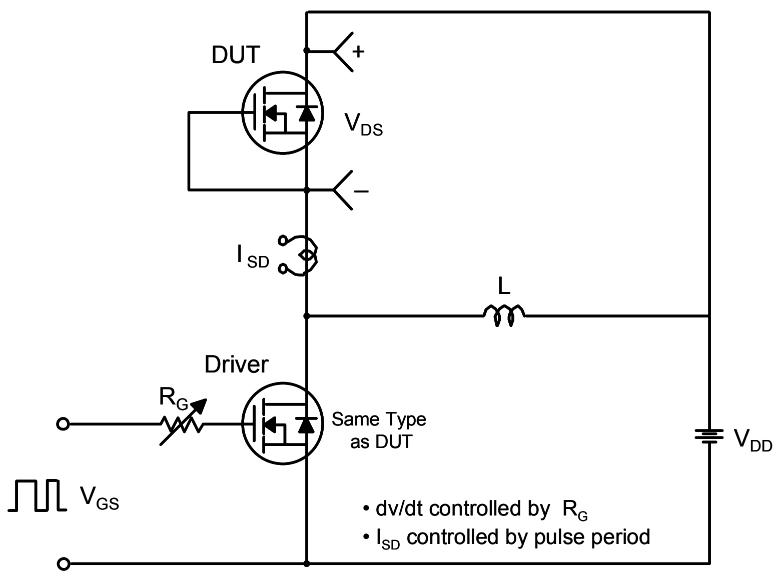

**Resistive Switching Test Circuit & Waveforms**

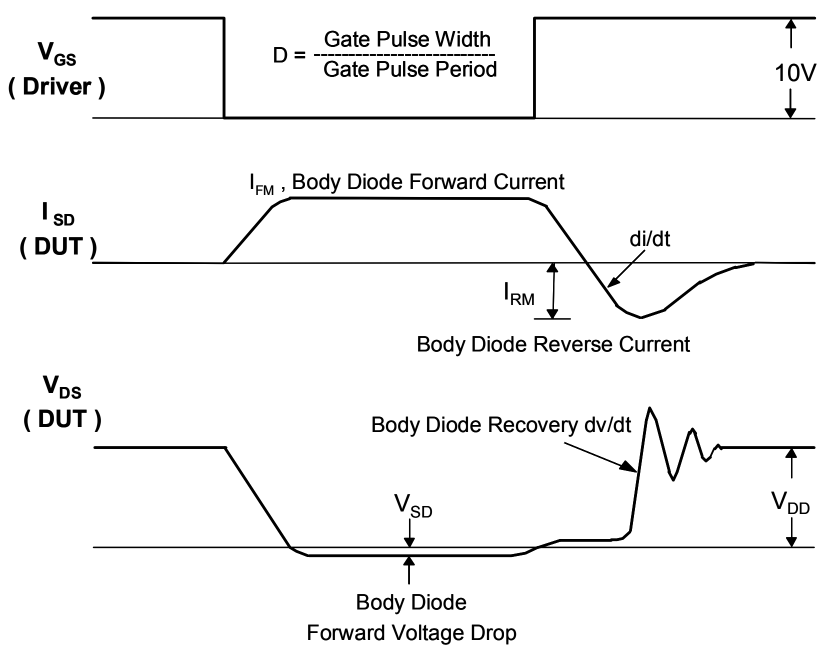



**Unclamped Inductive Switching Test Circuit & Waveforms**



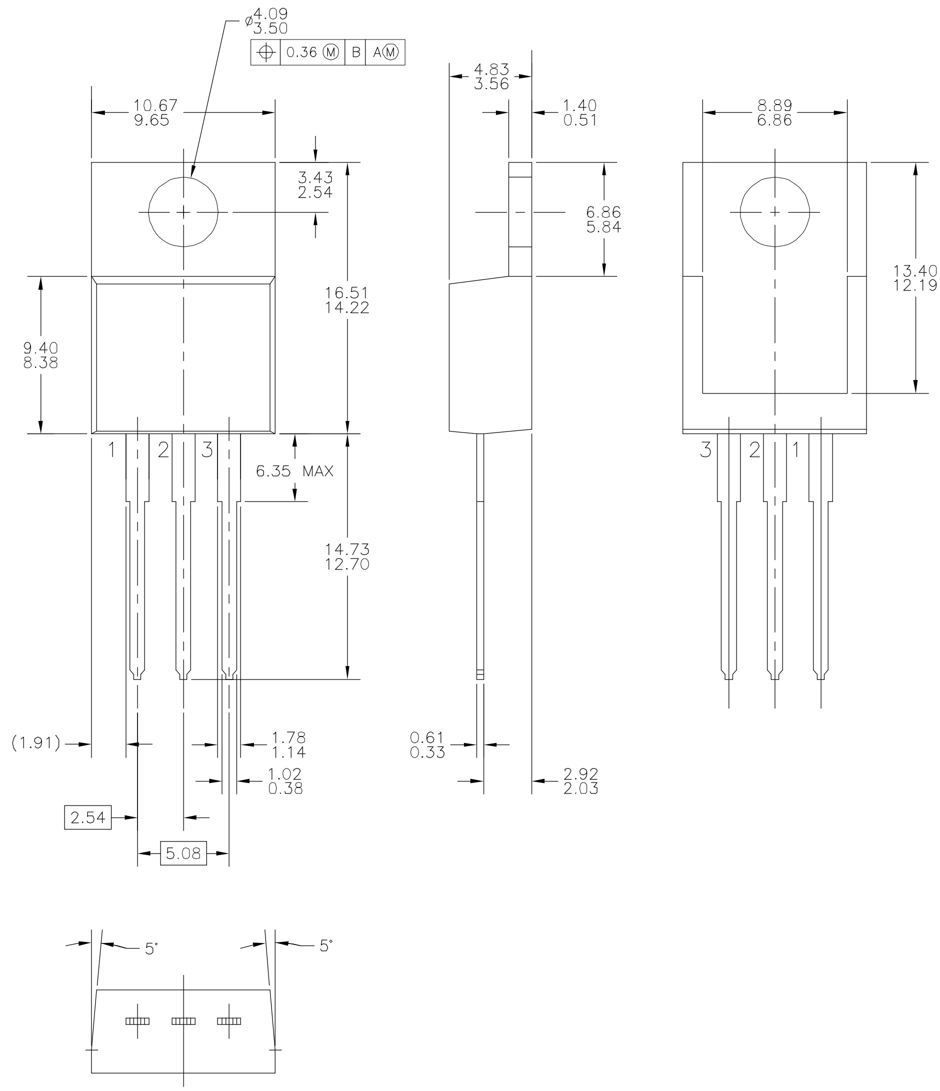
**Peak Diode Recovery dv/dt Test Circuit & Waveforms**



## Mechanical Dimensions

TO-220




Dimensions in Millimeters

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